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Chlebove, Megan, "Chest CT vs. Reverse Transcription Polymerase Chain Reaction Testing for COVID Diagnosis" (2020). *Medical Imaging Senior Posters*. 1.
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Chest CT vs. Reverse Transcription Polymerase Chain Reaction Testing for COVID Diagnosis

MISERICORDIA UNIVERSITY

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What is CT?

- Computed tomography (CT) is a form of imaging in which x-ray images are taken with a beam that rotates around the patient, allowing images to be taken from all angles.
- The machine is connected to the computer that takes thee images and reconstructs them into axial, coronal, and sagittal views of the body

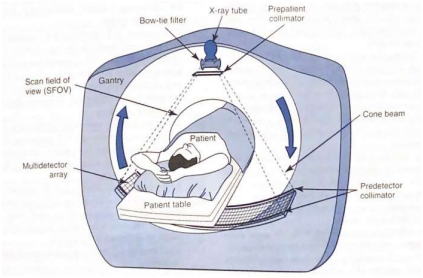

Image 1: Diagram of a CT machine

(DeMaio, 2018, p. 89)

What are RT-PCR Tests?

- Reverse transcription polymerase chain reaction tests are a form of nucleic acid tests and are the main form of detection of COVID.
- Samples for RT-PCR tests may be taken from sputum (saliva and mucus that is coughed up from the respiratory tract), nasal swabs, and throat swabs. The collected samples are taken to a lab and tested for viruses.

(Tahamtan & Ardebili, 2020)

False-Negatives in RT-PCR Tests

- There are many different places sample swabs may be collected, which makes chances for inaccuracy higher. The most common sample sites are from the respiratory tract because these forms of collection are easy and fast. Samples from the respiratory tract include:
  - Sputum is considered to be the most accurate type of sample
  - Nasal swabs are the second most accurate
  - Throat swabs may be done but are the least accurate form of sample and not recommended

False-Negatives (Continued)

- False-negative results may occur due to a lack of viral cells in the collected sample. This could happen because the sample was taken too soon after contact with the virus, or the swab may have been taken from a site that was not ideal, such as the throat.
- False-negative results may also be due to the material used to swab or transport of the sample to the lab.
- Samples should be brought to the lab as soon as possible after collection
- Samples should be collected using dacron or polyester material swabs

(Tahamtan & Ardebili, 2020)

Ground Glass Opacities

- Ground Glass Opacities (GGOs) are areas of increased attenuation within the lung tissue. GGOs are common in COVID patients but are also common in patients with other lung diseases and therefore cannot be used for identifying one specific disease.

(Long et al., 2020)

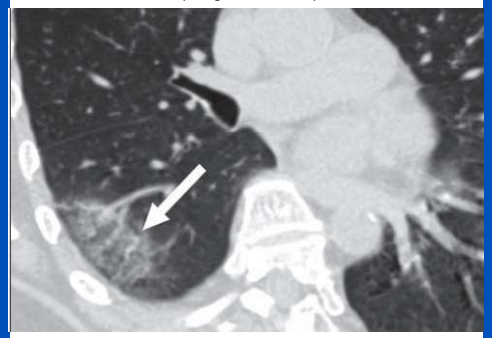

Image 2: Arrow points to a GGO present in a 61-year-old COVID patient.

(Li & Xia, 2020, p. 1282)

Pros of Using RT-PCR and CT in Conjunction with one Another

- CT scans allow for doctors to visualize the lungs. Because RT-PCR results can often show false-negatives, CT can show characteristics of COVID present in the lungs.

Pros of Using RT-PCR and CT in Conjunction (Continued)

- Characteristics common in COVID patient's lungs include GGOs and consolidation.
- If these things are seen on a chest CT of a person whose RT-PCR test is negative, these findings should prompt a second RT-PCR test, allowing for proper diagnosis of COVID.

Image 3: A chest CT of a patient who tested negative for COVID on January 16, 2020

(Li & Xia, 2020, p. 1284)

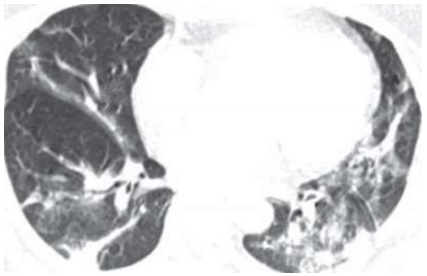

Image 4: Chest CT of same patient in Image 3 on January 27, 2020. Patient tested positive for COVID on January 27 and was re-tested because of findings on the original CT scan on January 16.

(Li & Xia, 2020, p. 1284)

Cons of Using RT-PCR and CT in Conjunction with one Another

- Use of CT can be incredibly helpful in finding the effects of COVID on the lungs, but the characteristics of COVID can appear to be other respiratory diseases as well.
- GGOs can indicate many things and there is no way to tell what from simply looking at the scan

Artificial Intelligence to Identify COVID on Chest CT Images

- The possibility of being able to use artificial intelligence to be able to tell the difference between COVID GGOs and other respiratory disorder GGOs does look promising but is only in the beginning stages.
- A study was conducted in February 2020 in which an artificial intelligence deep learning software was developed to deconstruct and analyze CT scans of both COVID and non-COVID patients.
- The software examines areas of interest to determine specifically which virus the patient had contracted.
- The software accurately detected COVID in scans 90% of the time.
- While the software accurately diagnosing COVID 90% of the time is promising, the goal of this software is for it to be 100% accurate, in order to rely on solely CT imaging for COVID diagnosis.
- The study was done using scans from only one hospital and there was no way to determine what area of the scan the software was specifically looking at.
- The results of this study show that the use of artificial intelligence could be something for the future, but the software would have to be tested more and perfected in order to be relied on.

(Lin et al., 2020)

Conclusion

- RT-PCR tests are considered the standard for diagnosis of COVID but can produce false-negative results based on the area swabbed, the material used to swab, or the amount of viral cells on the swab.
- CT had showed the features of COVID in the lungs and prompted further testing in patients with negative results, but there is no way to tell if GGOs shown in CT scans are COVID-related or related to other respiratory disorders.
- Both RT-PCR tests and CT are extremely useful tools for COVID diagnosis but neither one form of testing should be relied on for diagnosis at this time.

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